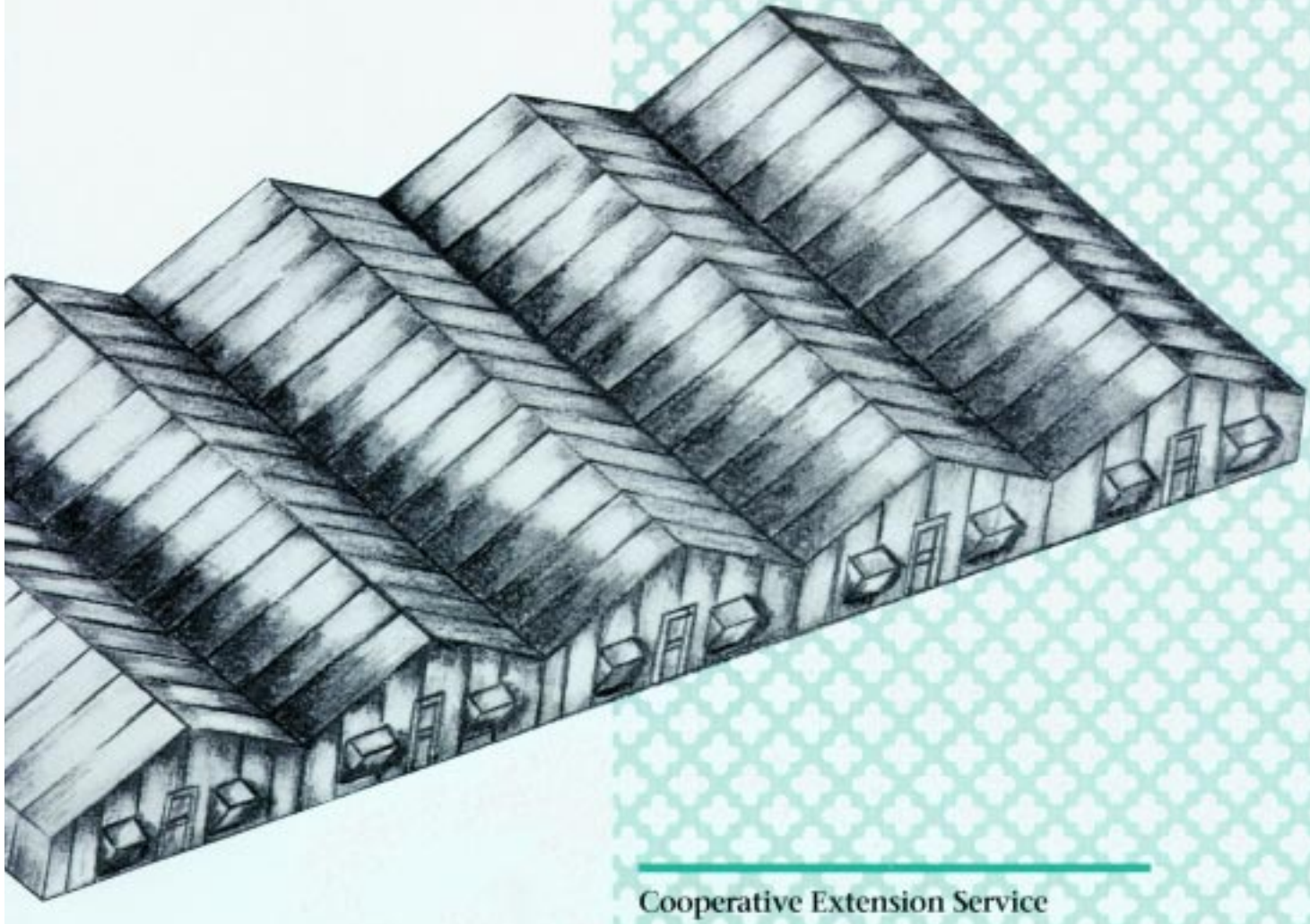
STARTING A Greenhouse BUSINESS

A COMMERCIAL GROWERS GUIDE



Cooperative Extension Service
Kansas State University
Manhattan

“More than anything,
I must have flowers,
always, always.”

—Claude Monet

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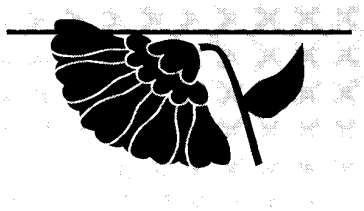
Starting a Greenhouse Business

A commercial greenhouse is a factory—one in which the product is perishable at all stages of the production process. It requires continuous management, 24 hours a day, seven days a week, 52 weeks a year At no time can the needs of the product be forgotten. But it is a business which, for all its demands, can yield both financial and emotional profits.

Greenhouse growing is an intensive form of agriculture. Production is measured on a per square foot basis, rather than per acre as in field production. Considerable capital is invested into structures and plant materials. It is also labor-intensive. Greenhouse owners need a basic knowledge of marketing, human resources management, production and operations management, plant culture, finance and building maintenance. With little room for error, careful planning becomes essential. All in all, the greenhouse business is not one to enter into lightly or unprepared.

This publication outlines the resources needed to successfully start a greenhouse business. First, investigate the market for greenhouse products and determine which crops are in demand. This process will help you decide whether a retail or wholesale operation is best suited to your goals. You also need to find a suitable location, and determine which type of greenhouse structure will best meet your requirements and available capital.



Marketing Plan

Determine the market potential of a crop before you grow it. What sells (or what is missing) in florist shops, grocery stores, mass merchants, garden centers and other retail plant outlets in and around your area? What products, sizes and quantities are in demand? Local landscapers and professional gardeners may have information on potential new crops. The type of operation you decide to have (wholesale or retail) will also help determine the best crops to grow.

Analyze the competition. You must know and understand your competitors before you go into business and commit your time and dollars. What are their strengths and weaknesses? Can you achieve a competitive advantage? Will it be sustainable over time?

Consider your customer base. Who is going to buy your products? Why will they buy from you, and not from your competition? In other words, what will be your advantage over the competition in your target market?

Wholesale

A wholesale production greenhouse sells relatively large amounts of a variety of plants to a relatively small number of accounts. Wholesale growers may sell to other wholesalers, who then resell the products. They may also sell to florists, garden centers, grocery stores, mass merchants, landscapers, grounds maintenance firms and other retail plant outlets. If several of these operations in your area need products, consider entering the market as a wholesale grower. There are three basic approaches to the wholesale greenhouse business.

Wholesale-daily sales. Wholesale-daily greenhouse firms produce a broad range of crops simultaneously throughout the year. The exact product mix is designed to meet the customers' plant needs on a day-to-day basis.

Wholesale-seasonal sales. Wholesale-seasonal greenhouse firms specialize in the most popular crops sold during a season or for a holiday. They produce a range of sizes and cultivars of each crop to broaden their product mix. For example, at Christmas a grower may offer red, white, pink and bi-color poinsettias, each color in several pot sizes. The grower would then produce other crops for Valentine's Day, Easter, Mother's Day and Thanksgiving.

Wholesale-contract sales. Wholesale-contract growers produce specific crops under contract for their customers. Many large retail companies with multiple outlets contract "specials" from wholesale growers. These are specially designed and produced plant products for sale as advertised specials of the week. Often, these programs are set up for a season or an entire year on a single contract.

Retail

A retail greenhouse sells relatively small amounts of plants to a relatively large number of individual customers. It sells to the general public, the final consumer of the product. There are two basic approaches to the retail greenhouse business.

Retail merchandiser. Retail merchandisers do not produce any plants; they purchase all their plants from wholesale growers. The greenhouse provides an environment to maintain the plants' health until they are sold, and plant care techniques are designed to maintain plant health and vigor, not to increase size. Hopefully, the plants will be sold before they have a chance to grow at all. The intention is to turn the plants over quickly, because retail display space is expensive.

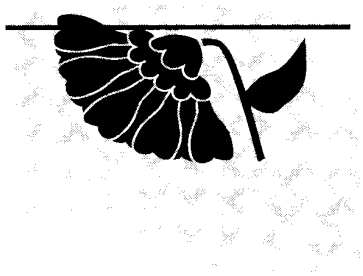
Retail grower. Retail growers produce a variety of plants to sell through their own retail operation. The exact mix depends on the type of business. For example, a grower with a garden center may only produce crops that sell between March and October and are used in a home landscape. A grower with a florist shop may

produce crops for sale as gifts during the high demand/high price period from Thanksgiving to Mother's Day.

These two basic approaches to retailing may be combined to varying degrees. The following are some examples.

To maximize the number of crops grown in a year and to minimize the length of time each crop is in the greenhouse, some growers purchase pre-finished plants which they then grow to flower. For example, a grower may purchase poinsettias in the first week of October and then grow them for 8 to 10 weeks until they flower. Traditional wholesale growers would have the same crop in the greenhouse for more than 17 weeks. Another strategy is to produce only those crops that are in short supply or highly profitable and purchase the remainder from local suppliers. For example, in the spring, high-quality flowering baskets, geraniums, impatiens and begonias may be in short supply and difficult to buy from wholesalers. Growing these crops yourself could be profitable.

You need to consider two other factors before undertaking a retail operation: your own retailing interest and zoning restrictions. Many growers choose to go into wholesale production simply because they do not want to deal with consumers on a daily basis. Zoning restrictions may prohibit growers from operating a retail business on their property. Check with the appropriate local zoning office before beginning a retail enterprise.



Site Selection

Location, location, location. The location of your greenhouse could govern your future profits, so choose a site carefully. But before determining the site, layout and orientation of your greenhouse, decide how and where your crops will be marketed.

Wholesale

Locate your wholesale greenhouse where zoning restrictions will not limit expansion. Consult your county Extension agent about restrictions that apply to a greenhouse operation. Also, determine the specific licenses and permits required to operate a greenhouse. For example, only certified users may apply restricted-use insecticides. All local, county and state building codes will have to be followed.

Retail

Be sure to locate your retail operation close to consumers to increase customer traffic. Pick a site on a well-traveled road, near major highways or within 20 minutes of consumers. Also, as a retail operator, you will be required to have a sales tax collection permit. Contact your county Extension agent for directions to the appropriate departments to obtain permits and licenses.

Site Characteristics

After determining your market, customer base and location, consider the following factors when evaluating a potential site: proximity to utilities, water supply and quality, proximity to labor force, greenhouse orientation, roadways, topography and natural windbreaks.

Proximity to utilities. A greenhouse requires sizable amounts of electricity and natural gas. Power and gas lines are expensive to run. A location with power and gas on site may be more valuable than one without utilities. Also, check for easement requirements to bring any nonexisting utilities to the proposed greenhouse site.

Water supply and quality. Each year you will need up to 6 acre-feet of water for every acre of greenhouse. Water sources include wells, ponds or city utilities. Low-yielding wells can be used by pumping water into holding tanks or ponds, and then pumping from these large reservoirs at high-demand times.

Not all water is suitable for irrigation purposes. Before using any water, have it tested by a commercial water-testing lab that has experience with greenhouse water requirements. State and local health department water tests will not alert you to excessive sodium, iron or pH problems that should be corrected before using the water for plant irrigation. Pond water may need to be chlorinated at the time of use to kill algae and root rot organisms.

Labor Force. Running a greenhouse is labor-intensive. Experienced labor can be difficult to find, so make sure you investigate the supply of both skilled and unskilled seasonal help in your area. Your labor force and support services should be within 20 minutes of the site. For many greenhouses, labor requirements peak from February to June. Try various approaches to attract skilled employees, such as allowing workers to create their schedules and including retired and people with disabilities in the employee pool.

You can reduce labor requirements with equipment such as automated irrigation, computer-controlled heating and cooling systems and automated seeders and potting machines. After the initial expense, these devices can enable growers to increase productivity with fewer, better-trained, permanent employees.

A critical factor in overall site design should be to minimize the labor required to move materials into the greenhouse and to move the finished plants from the production bench to the customer. As much as 75 percent of all greenhouse labor may be utilized in completing these non-growing functions.

Greenhouse orientation. A greenhouse must be free from winter and summer tree shadows. Make sure you have enough space for expansion of greenhouse and support areas. When possible, orient connected greenhouses north to south to provide even light coverage within the houses throughout the day. Construct freestanding houses with the length running east to west. Place cooling exhaust fans so that they will not be required to blow against prevailing summer winds.

Roadways. Your greenhouses must be accessible for delivery of supplies and pickup of finished plants. Retail operations should separate customer and service entrances and provide sufficient parking. However, locating the greenhouse near parking areas with night lighting may limit the types of crops you can grow.

Topography. Natural topography is important. Choose a site where a minimal amount of dirt will have to be moved to provide a level construction and parking site. The slope of the land should not be more than 5 percent. Greater slopes drain worker energy, affect product movement, and generally reduce labor efficiency. Avoid flood plains, frost pockets and hilltops.

Windbreaks. A windbreak of trees will reduce heat loss from greenhouse surfaces during the winter. This may have a dramatic effect on heating costs.

Site Selection

Your greenhouse should be engineered for your location and climate. Climatologically, Kansas is in a transition zone, a location where it "enjoys" the worst of both the cold north and the hot south; often, on consecutive days. Greenhouses must be designed to provide an appropriate environment for plant growth under these climatic extremes.

Greenhouse Coverings

The greenhouse covering is the primary decision when choosing a greenhouse design. The different types of greenhouse coverings, or glazings, can be used on the bowed, quonset-style greenhouse or the A-frame, peaked-roof greenhouse. When either style of greenhouse is connected at the eaves or gutters, the greenhouses are known as gutter-connected houses. The connected A-frame greenhouses will also be called a ridge-and-furrow greenhouse. The rigid types of glazing materials are used on A-frame greenhouses. Some of the rigid, structured plastics (polycarbonates and acrylics) and non-structured plastics (fiberglass and polycarbonates) have enough flexibility to span a quonset-style greenhouse. Polyethylene film plastics are most commonly used on quonset-style greenhouses (poly-houses). The different glazing materials have different characteristics, associated costs, and require different support structures. Therefore, selection of the glazing material needs to be made before selection of the structure.

Polyethylene Films. The major advantage of polyethylene film plastics is cost, which is why new growers often choose a poly-house design. The greenhouse structure itself, and the polyethylene plastic covering, are considerably less expensive to purchase and install. When using two layers of polyethylene, with an insulating air space between them, there is a 40 percent savings in heating costs over single-layer polyethylene, glass, or fiberglass. Double-layer polyethylene also tends to resist hail damage (Table 1).

The polyethylene plastics have a UV inhibitor which has extended useable life to three years depending upon thickness of the plastic and the manufacturer. Some newer materials are being introduced which reportedly extends the life up to four years. However, the polyethylene film still needs frequent replacement, a major disadvantage over time. There are problems near the end of the life of the plastic. As it ages, it becomes brittle, increasing the risk of tears.

Most poly-houses are built with extruded aluminum or galvanized steel. Depending upon span and intended use, there may or may not be a truss or horizontal support members. Because of the structure and short-term nature of the polyethylene film, insurance costs can be greater than in comparison to other materials.

Rigid Plastic. The rigid plastics are corrugated and flat fiberglass (fiberglass reinforced plastic), structured acrylics, and corrugated and structured polycarbonates. Corrugated fiberglass sheets are used for their greater strength. However, the major drawback is that corrugated sheets have a greater surface area than flat sheets allowing for greater heat transfer. The outer layer needs to be coated with a UV inhibitor to minimize yellowing of the acrylic resins used in the manufacture of the sheets. If this coating is damaged from hail, other abrasives, or air pollutants, dust and dirt will collect on the surface and light transmission will be reduced. Most fiberglass coverings are warranted to maintain 80 percent light transmission for the first 10 years and structural integrity for up to 20 years. A major problem with fiberglass is it is highly flammable and supports rapid combustion because of the acrylic resin. This increases insurance costs, and may not be an acceptable covering (building codes) for school system teaching greenhouses.

The structured acrylic and polycarbonates are very similar in characteristics. The structured rigid plastics are double-layered and ribbed for strength, creating

an air pocket reducing heat loss. Panels come in thicknesses from 6 to 16 millimeters thick with growers gaining up to a 50 percent heat savings with the 16-millimeter panels; up to 30 percent with the 6-millimeter panels. The polycarbonate panels are more resistant to hail damage than the acrylic panels; some are warranted against hail damage for five years. The acrylic panels are flammable; the polycarbonate sheets are not. The acrylic and polycarbonate plastics are also available in bronze colored panels which reduces light intensity. These can be used where reduced light is an advantage such as retail display areas to make the environment more comfortable for the customer.

The polycarbonate rigid plastic is also available in a corrugated sheet (Dynaglas®). This provides greater light transmission than the structured polycarbonate panels, however, heat loss is comparable to corrugated fiberglass. The thinner structured acrylic and polycarbonate panels, and the corrugated polycarbonate sheets, are flexible and can conform to the shape of a quonset greenhouse. They are also used on A-frame greenhouses. Because these come in widths from 48 to 72 inches, fewer structural members are needed in greenhouse roofs and side walls than if glass construction is used, helping to reduce the cost of the structure. However, these materials are very expensive in comparison to double-layer polyethylene. Price is comparable to glass.

Glass. The major advantages of the glasshouse are the high interior light level and its long life. The stability of a glasshouse provides good crop protection under bad weather conditions. For example, extremely wet snow may cause a double-layer polyethylene house to collapse. A properly designed glasshouse may lose some panes, but would not collapse. Tempered glass is strong enough to withstand most hail. The major drawbacks to glass are heat loss and high initial capital investment resulting from a more expensive structure, the glass itself, and greater installation costs. Glass panes come up to 39 inches wide and up to 65 inches long. Since the panes are more narrow than the rigid plastic panels or sheets, and because glass weighs more than the plastics, more support members are needed. The greenhouse structure will be more costly.

A common compromise in greenhouse coverings

Roof. Cover the roof with double-layered polyethylene. The roof represents the largest surface area of the greenhouse exposed to the outside air. By covering the roof with polyethylene, the cost for covering the greenhouse can be reduced and a savings on heating costs can be gained.

End and side walls. The end and side walls can easily be covered with one of the rigid plastics. The structured acrylics and polycarbonates will provide better insulation and security against theft or vandalism, but at greater initial costs, than fiberglass. Since the structured plastics come in 8- or 10-foot panel lengths, less cutting and splicing will be needed in comparison to polyethylene which comes in a minimum of 20-foot wide rolls. Also, the side and end walls run greater risk of being damaged by equipment movement. The structured plastics will be more resistant to this type of damage than polyethylene.

Growers who decide to cut expenses with used materials or to build a greenhouse themselves should be careful to weigh structural soundness along with cost. Greenhouse structures are designed with the glazing material in mind. Some structures, when recovered with a different material than what it was originally engineered for, may loose structural integrity after glazing and be more susceptible to wind or snow-load

Table 1. Influence of hailstone diameter and velocity on damage to four classes of greenhouse glazing materials.

Class of material	Diameter of hailstone (mm)							
	10		20		30		40	
Float glass	30*	67†	10	22	8	18	7	16
Polyethylene	40	89	25	56	20	45	<10	<22
Acrylic	18	40	10	22	7	16	5	11
Polycarbonate	>50	>112	>35	>78	>30	>67	>10	>22

* Velocity of hailstone in meters per second (m/s) when damage (holes or dents) is first observed.

† Velocity of hailstone in miles per hour (mph) when damage (holes or dents) is first observed.

damage. Homemade wooden structures are bulky and can adversely affect light distribution and/or restrict air circulation within the structure.

Greenhouse Structure. Several items need to be taken into consideration when deciding on the greenhouse structure. First, of course, is the glazing material. The weight and flexibility of the material will influence design of the structure. Climate factors such as snow-load, wind, and the amount of sunlight, will also influence the needed strength of the glazing material, structure and members. The weight of equipment such as thermal curtains, overhead racks for hanging baskets, and high-intensity discharge lights, needs to be distributed to the load bearing members of the frame. Finally, the width of the greenhouse will also influence the truss size and design. Each manufacturer will specify the appropriate thickness of steel members or aluminum extrusions. Trusses, and gutter and side posts are spaced 6, 10, or 12 feet apart depending upon the manufacturer. Roof and side bars are spaced between the trusses depending upon the width of the glazing material being used. For glass, the bars will be much closer than for the rigid plastics.

Other factors to consider before selecting a greenhouse manufacturer are the thickness of the galvanization coating on steel, free-standing versus gutter-connected greenhouses, and gutter height. If hanging baskets will be produced or if overhead equipment, such as shade cloth or thermal curtain systems, will be used, the gutter height should be increased.

Climate Control Systems. Greenhouses need to be heated, cooled, or ventilated depending upon the time of the year. These systems need to be integrated to obtain maximum efficiency.

Heat can be provided by central boilers generating hot water or steam, or by individual unit heaters hung in the greenhouse. Fuels used to fire the heaters or boilers are natural gas or liquid propane. Electric heat is prohibitively expensive. If boilers are used, smaller multiple boilers are preferred over one large boiler capable of heating the entire range. Multiple units allow for zoning and can provide minimal heat requirements in case one boiler fails. Steam or hot water is distributed through the greenhouses in a radiant heat pipe system.

Unit heaters are gas-fired, or operate from steam or hot water generated in a central boiler room. Unit heaters are located at gutter height in the greenhouses. Warmed air from the unit heaters or radiant pipes is distributed by means of horizontal air flow fans or polyethylene tube systems. Regardless of the heating system utilized, thermal curtains can be installed to insulate the greenhouse from extremely low nighttime winter temperatures. These are normally installed at gutter height and span across the greenhouse. Installation of thermal or heat retention systems will have an influence on the selection of the greenhouse structure.

The horizontal air flow fans or polyethylene tube (fan-jet) systems are also used to recirculate air when no additional heating or cooling is needed. Air circulation throughout the greenhouse is important to prevent hot or cold spots, and to minimize disease problems resulting from high humidity pockets developing about the plant canopy.

Greenhouses need to be equipped with exhaust fans to exchange inside and outside air, and to equalize temperatures within the greenhouse. To reduce greenhouse temperatures on sunny winter days, an inlet louver is installed adjacent to the fan-jet system. This inlet louver will open to draw in fresh, cool outside air and is circulated through the fan-jet system. To reduce summer greenhouse temperatures, exhaust fans used in conjunction with evaporative cooling pads (made from corrugated cellulose) are necessary. The energy required to evaporate water from the pads cools the air drawn across the pads helping to reduce the interior greenhouse temperatures.

Floor. Growers may choose from a range of floor surfaces: bare ground to concrete. The actual floor design will be dependent upon the type of production being planned and the available capital. Bare ground will create management problems: insect and disease control and a muddy work environment. Where capital is limited, heavy plastic or special woven, weed barrier cloths can be installed between gravel aisles. If there is a need to have carts and other wheeled-equipment, concrete aisles are preferred. Entire concrete floors will help minimize weed growth under benches, reduce insect and disease host habitats, and allow for capture of run-off into holding ponds. Run-off capture and recycling have become critical concerns since greenhouses can contribute to ground and water contamination. Holding and settling ponds are designed so that water from greenhouse run-off (roofs and interior irrigation systems) can be reused in production or purified before introduction to the ground water.

Benches. Although plants can be grown on the ground, accurate and uniform temperature control is difficult to achieve. When grown on the ground, there is a greater risk of spreading certain diseases among plants. Most

potted greenhouse crops are grown on benches that are 32 to 36 inches tall. Width varies with location in the greenhouse: 3 feet wide against a wall, up to 6 feet wide, if accessible from both sides, with 18 inch aisles. Center aisles and/or traffic aisles should be from 3 to 12 feet wide to be able to accommodate movement of equipment such as carts and sprayers. On fixed bench arrangements, a 60 to 70 percent bench efficiency can be expected. This can be improved by utilizing peninsular benching, when small bench surfaces are installed adjacent to the endwalls between benches. Movable aisle benching can increase bench efficiency to near 90 percent, however, these are expensive systems to install. In greenhouse retail sales area, bench efficiency will be reduced to allow for easy traffic flow. Additionally, with new construction of retail space, benching aisle dimensions need to conform with the Americans with Disabilities Act in order to provide access to all customers.

Benching materials should allow for air circulation around the plants and drainage from the containers. This is to minimize disease problems and to allow for complete coverage by fumigant and fogged pesticides. Common bench surface materials are: red wood lath in woven wire, red wood boards with ¼- to ½-inch spaces, l-inch square 14-gauge welded-wire fabric, and expanded steel mesh. These materials are supported on frames made from wood, pipe, or extruded aluminum supported by concrete block or aluminum pipe-frames.

Bench efficiency can be increased for some crops. It is not uncommon to produce bedding plants directly on the floor to allow for greater use of greenhouse space—fewer aisles will be used. It is also common to produce hanging baskets suspended from supports hung over aisles and under gutters.

Root-zone Heating System. Some form of a root-zone heating system will be needed if plant propagation is planned. For seed germination and rooting of cuttings, an area should be equipped with a hot-water distribution system. Root-zone heating can be installed as part of a concrete or gravel floor. Heat-resistant polybutylene pipe, recirculating pump, thermostat controls, and commercial-sized hot-water heaters are required. Simpler hot-water systems utilizing residential hot water heaters and on-bench tubing are available.

Storage and Work Space

Warehouse storage and work space is often overlooked in designing a new business. Without storage and work space, material costs increase and labor becomes inefficient. Bales of peat moss and pre-mixed potting media should both be stored out of the sun and weather, because the plastic packaging may split with exposure to ultraviolet rays from the sun. Cardboard boxes disintegrate in the rain. Fertilizer forms hard clumps from moisture. A separate space for chemical storage is needed, and it must be constructed to meet current governmental requirements. Consult your local county extension agent for more information.

Work space is required to mix potting media, fill pots, potting and transplanting activities, place plants sold and waiting to be delivered, and to load or unload trucks out of the weather. A most efficient space design is one where storage is located adjacent to the work space, reducing the distance materials must be transported.

Site Plan

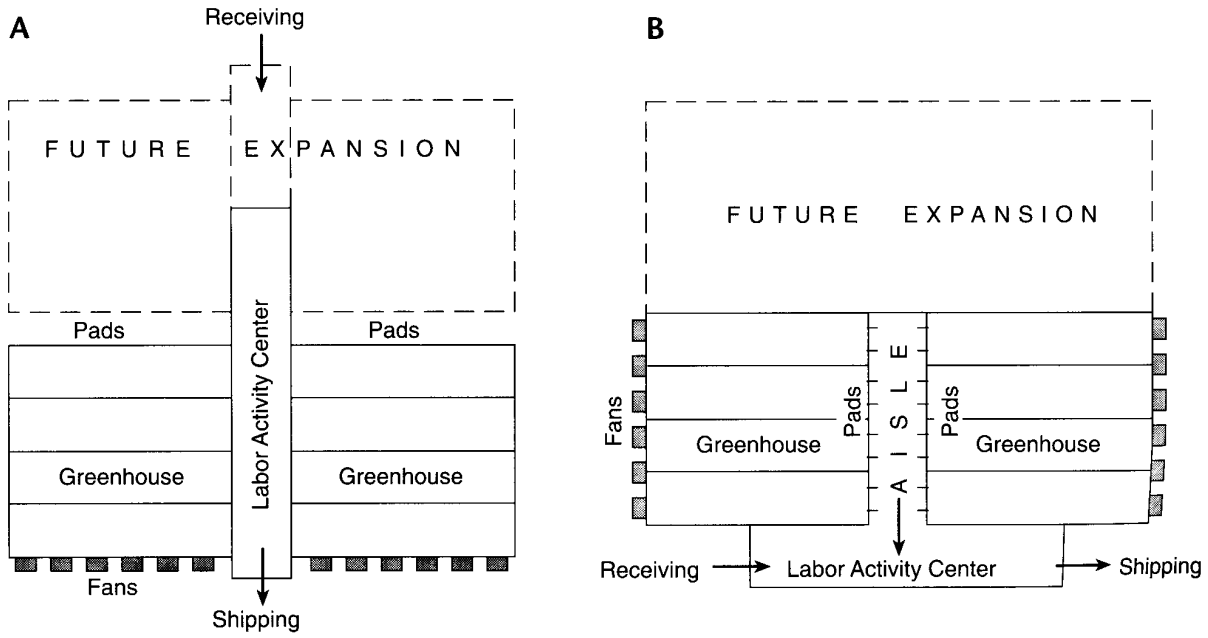
Production. The primary factor in all site and building arrangement considerations is material flow and how it affects labor utilization—how will materials come in, move through the production process, move out, and be delivered to customers.

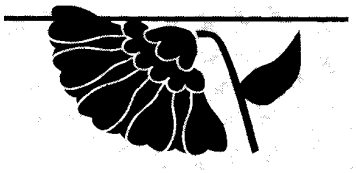
- Where will each input (material) be delivered?
- How will it be unloaded?
- Where will it be stored until needed?
- Where will labor activities take place?
  - mixing potting media
  - potting and transplanting
  - fertilizer mixing and injection
  - pesticide mixing and storage
  - moving plants into and out of the greenhouse
  - packing plants for delivery to customer
  - staging orders for delivery
  - loading trucks both in the cold of winter and heat of summer

The site must be designed for a material flow which optimizes labor utilization. Labor is the largest single expense in a greenhouse business. Whether you will be paying an employee or doing the work yourself, the inefficient use of labor is a cost to be avoided.

Retail. Material flow and customer access to products is also critical within a retail operation. A retail greenhouse facility must be designed for ease of product movement through the operation. How will products for sale move from the delivery truck to the sales display area, from the display to the check-out register, and from check-out to the customers vehicle?

Site Plan Examples.





Crops

What crops should you grow? The simplest answer is to grow what you can sell. Marketing should drive production. Don't grow it if you can't sell it. A more complex answer is to only grow what you can sell profitably—only grow what you can grow at a cost structure low enough and sell at a price high enough to make a profit.

The critical side of the profitability equation is the cost side. Competition sets price. It is difficult to charge more than the competition and it may not be profitable to charge less. Cost of production must be considered in choosing a crop and the method of producing the crop. The difference between cost and price, the margin, must be great enough to operate the company, pay yourself a wage, justify the risk of being in business and provide a return on your investment.

Quality should be considered a given. Do not sacrifice quality to lower cost. Without quality, you will not survive in the market. Design your plant products and production systems to operate with the lowest possible cost structure to market a quality product.

Bedding Plants. Annuals and perennials grown and sold for planting in landscape flower beds can be profitable crops. It is possible to produce multiple crops of bedding plants in the same space during the spring sales season. Tight scheduling and effective use of greenhouse space offers the opportunity to spread fixed costs over more than one crop. With good management and cooperative weekend weather, bedding plants can have excellent returns to a greenhouse.

Depending on the particular plants being grown, and the weather through the spring, production of bedding plants begins around January. Sales begin in March and are concentrated during weekends in April and May.

Bedding plants are sold at wholesale to garden center, florist, grocery, mass merchant, hardware, produce and other retail outlets and to landscape contractors.

Flowering Potted Plants. Flowering plants grown in pots provide opportunity for year-round production and sales. Peak demand season is Thanksgiving through Mother's Day.

Some plants, such as chrysanthemums, are planted each week, grown and sold, throughout the year. Others, like poinsettia and Easter lily, are produced for specific holidays.

A grower of blooming potted plants must be skilled in both production and marketing. Timing of production and sales is critical on blooming plants. The flowers are at an optimal stage of maturity for only a short time period. The plants must be grown and be ready for sale when a sales opportunity exists, i.e. before, not after, a holiday. The plants must be sold when ready for sale. A week later, the flowers may be past their prime.

A profit opportunity exists in the production and sales of flowering potted plants. They are marketed on the wholesale level to florist, garden center, mass merchant, grocery and other retail outlets.

Potted Foliage Plants. Foliage or house plants enjoy a popularity in the marketplace. The skill level required to grow and sell foliage plants may be slightly less than for blooming plants. If not sold today, they should be larger and maybe more attractive tomorrow.

Potted foliage plants require extended periods of production time to reach marketable size. It may not be economically feasible to produce many species of foliage plants in Kansas, but opportunities do exist. Plants in a 4-inch size pot may be purchased and potted into a 6-inch pot in July, grown for eight weeks and sold in September or October. The production period during the summer and fall does not require the greenhouse to be heated. A lower cost structure production process.

Cut Flowers. Specialty cut flowers can be profitable crops. Specialty cut flowers are defined as any cut flower, other than roses, carnations or chrysanthemums, sold in the commercial marketplace. The greatest opportunities lie in local or regional markets for specific market windows associated with holidays. Peak sales season for cut flowers is from late October through Mother's Day. A market also exists for specialty cut flowers used in summer wedding bouquets. International competition and local climactic conditions make the greenhouse production of cut roses, carnations or chrysanthemums in Kansas economically questionable.

Fall and winter production of cool-temperature cut flower species in a greenhouse space rotation with spring bedding plants can be an excellent way to maximize the productive capacity of the greenhouse facility. Cut flower crops might be produced for Thanksgiving, Christmas, and Valentine's Day with the space then rotated into bedding plant production.

Cut flowers are sold to retail and wholesale florists, grocery store floral departments, produce markets, garden centers with floral departments and direct to consumers from the greenhouse or outlets, such as farmer's markets in the summer months.

Operations Management

A commercial greenhouse is a factory. Anyone considering starting in the greenhouse business needs a basic understanding of the greenhouse production process.

If a new person asks what they need to know about greenhouse production, they are usually told about watering, fertilizing, insects and diseases—everything involved with the actual growing of the plants. All of these activities are important in producing a quality plant. But, they are only a part of the production process. The care as needed activities represent only a minor portion of the labor required to produce a plant. Watering labor is minimal especially with automatic irrigation. Fertilizer is applied through the irrigation lines. With good basic cultural practices, insect and disease control does not require large blocks of time. The activities we think of as growing our product, the care as needed activities, typically account for only about 25 percent of the total labor required in producing our product. Yet, these are the activities most growers concentrate on.

Potting, those activities involved with bringing all inputs together and onto the greenhouse bench, accounts for another 20 to 25 percent of total direct labor. These are all production activities. They are all accomplished before we begin to grow our product. The manner in which they are done has a strong influence on the efficiency of the care as needed activities and the quality of the final product. Inconsistent media mixing, potting the plant too deep or too shallow and non-uniform spacing of plants on the bench will all affect labor utilization during care as needed activities.

In many greenhouse firms, labor activities associated with harvest are the most poorly managed. By harvest, the product has been produced, and we are no longer growing anything. As plant people, our focus has been on growing. Approximately 50 percent (+/-) of all direct labor is used in harvest activities. The area of greatest labor expense is often the area least managed, at least as far as labor efficiency is concerned. Growers often fail to manage the labor used in the systems of selecting, grooming, moving, handling, staging and delivering the plants.

In commercial greenhouse production, labor is everything. If you manage labor you manage profit. Labor is by far the single largest cost of production. If it is not properly managed, costs of production will increase and quality will decrease.

Table 2.
The Stevens Model of Production, a representation of the production process.

Potting	all activities involved with bringing the pot, the media (soil), and the plant together as a single unit and placing it on the greenhouse bench ready to begin growth.
Care as Needed	all activities involved with the actual growing of the plants (product), i.e. watering, fertilizing, weeding, controlling insects and diseases, and environmental controls.
Harvest	all activities involved with harvesting and delivering the product to the customer, i.e. selecting, grooming, moving, packing, staging, loading and shipping.

Summary

The greenhouse business offers financial and emotional rewards for those who enter with knowledge and forethought.

Join Your State Trade Association

Kansas Greenhouse Growers Association. The KGGA is an association of commercial greenhouse growers, suppliers, educators, researchers and allied industry personnel who have joined together to promote the continuing education of its members, disseminating information, cooperating in research with Kansas State University, and organizing cooperation among all segments of the horticulture trade.

For information on the KGGA contact:

Kansas Greenhouse Growers Association
Department of Horticulture
Throckmorton Hall
Kansas State University
Manhattan, Kansas 66506
(785) 532-6170

Contact a Small Business Development Center

Free counseling is provided to anyone interested in starting a new business. Each center will provide guidance in marketing, finance, business plans, feasibility studies and in other areas of interest to those starting in business. The services are provided at no cost and all information is kept confidential. Low cost training programs in a variety of business topics are also offered. Kansas Small Business Development Centers are part of a national consortium of SBDC's affiliated with colleges and universities which provide assistance to small businesses.

Kansas Small Business Development Centers

State office
Wichita State University
1845 Fairmount, Wichita
(316) 689-3193

Emporia State University
207 Cremer Hall
Emporia
(316) 342-7162

Fort Hays State University
1301 Pine
Hays
(785) 628-5340

Colby Community College
1255 S. Range
Colby
(785) 462-3984 ext. 239

Garden City Community College
801 Campus Dr.
Garden City
(316) 267-9632

Dodge City Community College
2501 N. 14th Ave.
Dodge City
(316) 225-1321 ext. 247

Seward County Community College
1801 N. Kansas
Liberal
(316) 624-1951

Johnson County Community College
CEC Building, Room 223
Overland Park
(785) 469-3878

Kansas City Kansas Community College
7250 State Ave.
Kansas City
(785) 334-1100 ext. 228

Kansas State University
2323 Anderson Ave. Suite 100
Manhattan
(785) 532-5529

KSU-Salina College of Technology
2409 Scanlan Ave.
Salina
(785) 826-2622

Cloud County Community College
2221 Campus Dr.
Concordia
(785) 243-1435

Pittsburg State University
Shirk Hall
Pittsburg
(316) 235-4920

Allen County Community College
1801 N. Cottonwood
Iola
(316) 365-5116

Coffeyville Community College
11th & Willow Streets
Coffeyville
(316) 252-7007

Fort Scott Community College
2108 S. Horton
Fort Scott
(316) 223-2700

Independence Community College
College Ave. & Brookside
Independence
(316) 331-4100

Labette Community College
200 S. 14th
Parsons
(316) 421-6700

Neosho County Community College
1000 S. Allen
Chanute
(316) 431-2820 ext. 219

University **of** Kansas
734 Vermont, Suite 104
Lawrence
(785) 843-8844

Ottawa University
College Ave., Box 70
Ottawa
(785) 242-5200 ext. 5457

Washburn University
101 Henderson Learning Center
Topeka
(785) 231-1010 ext. 1305

Wichita State University
1845 Fairmount
Wichita
(316) 689-3193

Butler County Community College
600 Walnut
Augusta
(316) 775-1124

Hutchinson Community College
815 N. Walnut, #225
Hutchinson
(316) 665-4950

Pratt Community College
Highway 61
Pratt
(316) 672-5641

Greenhouse Resource List

General Suppliers

Standard Seed Co.
931-37 W 8th St.
Kansas City, Missouri 64101

Swecker-Knipp Inc.
900 NW Jackson
Topeka, Kansas 66608

Robert S. Wise Co.
1515 E. 29th St. N.
Wichita, KS 67219

A.H. Hummert Seed Co.
2746 Chouteau Ave.
St. Louis, Missouri 63103

Sharp & Son Inc.
281 East 55th Ave.
Denver, Co 80216

Clifford Sales & Marketing
44 Granada Way
St. Louis, MO 63124

Craig & Associates
P.O. Box 3467
Shawnee Mission, KS 66203

Vaughan's Seed Co.
P.O. Box 3473
Lawrence, KS 66046

All Hort Systems
P.O. Box 21554
Oklahoma City, OK 73156

Yoder Brothers Inc.
Bob Osman
1234 E. Dunklin
Jefferson City, MO 65101-4116

Fritz Thomas
1887 Duchess Drive
Longmont, CO 80501

Lite Weight Products
1706 Kansas Ave.
Kansas City, KS 66105

Paul Ecke Ranch
P.O. Box 230488
Encinitas, CA 92023-0488

Greenhouse Structures and Systems

Stuppy Greenhouse Manufacturing Inc.
1212 Clay St.
North Kansas City, Missouri 64116
Bruce Holden
(800) 877-5025

Linda Barnett
Vice President, Sales
(800) 877-5025

Nexus Greenhouse Systems
Tom Tinsman
10983 Leroy Drive
Northglenn, CO 80233

Bob Moncrief
Rt. 1, Box 286
Baxter Springs, KS 66713
(316) 848-3949

Envirogation Systems
17005 Manchester Rd.
Grover, MO 63040

Insurance

Millers Mutual Insurance Assoc.
Richard Holaday
Rt. 2, Box 42
Harrisonville, MO. 64701

Florists' Mutual Insurance Co.
Mike Lucas or Tom Scrivner
500 St. Louis Street
Edwardsville, IL 62025

Trade Magazines

Greenhouse Manager
P.O. Box 1868
Fort Worth, Texas 76101

Greenhouse Grower
37733 Euclid Ave.
Willoughby, Ohio 44094-9016

Grower Talks
P.O. Box 532
Geneva, Illinois 60134

How-to Reference Book

Ball Red Book
P.O. Box 532
Geneva, Illinois 60134
cost: approx. $55.00

Professional Organizations

Kansas Greenhouse Growers Association
ATTN: Dr. Alan Stevens
Dept. of Horticulture
Throckmorton Hall
Kansas State University
Manhattan, Kansas 66506
(785) 532-6170

Association of Specialty Cut Flower Growers
M.P.O. Box 0268
Oberlin, Ohio 44074
(216) 774-2887

Kansas City Growers Association
ATTN: Wayne Vinyard
Longview Gardens, Inc.
11801 E Bannister
Kansas City, Missouri 64138

Professional Plant Growers Association
P.O. Box 27517
Lansing, Michigan 48909

Society of American Florists
1601 Duke St.
Alexandria, Virginia 22314

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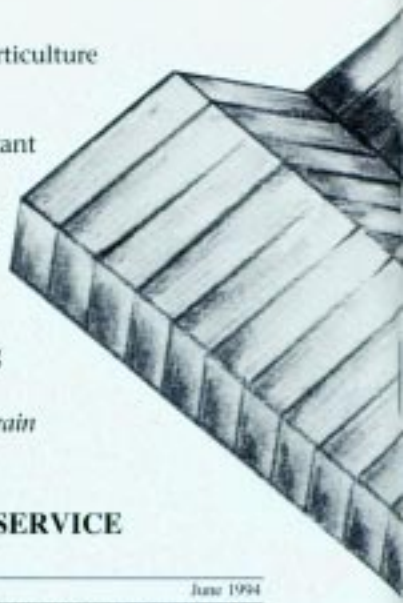

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